

**Japanese 8080A microprocessor forms heart:**

# NEC TK-80 system

Tecnico Electronics have released a single board microprocessor evaluation kit based on the 8080A MPU chip. It is the TK-80 system from Nippon Electric Co Ltd, and is based on the uCOM-8 family of LSI devices. A keyboard and LED display is provided on board for man to machine communications, making the unit fully self-contained.

by **DAVID EDWARDS**

In the past we have reviewed a number of microcomputer systems, produced by American companies but the unit reviewed here is unique in that it is of Japanese origin. It is an 8080-based system mounted on a single double sided printed circuit board, measuring 310 x 170mm. A number of rubber feet are fitted to the underside of the board, so that it is held away from the workbench.

A keyboard is fitted to the bottom right hand corner, with a LED display

covered with a transparent red window occupying the top right hand corner. Part of the board is formed into an edge connector, to facilitate external connections.

Most of the integrated circuits are fitted into sockets, with a number of extra sockets provided for expansion purposes. There is also a small area of the board, to the left of the keyboard, reserved for user-generated expansion circuits.

The large white IC is the 8080A chip,

with the RAM and ROM immediately above it. The remaining chips are support chips for the CPU and for the keyboard and display. Three documentation books are provided: a user's manual, a software manual and a program application manual.

The 8080ACPU chip is supported by an 8224 clock generator and an 8228 system controller. Three factory-coded uP464 ROMs are used to store the monitor program, while two 5101 CMOS RAM chips provide 512 bytes of user memory. Provision has been made to enable expansion up to 1k of RAM, and 1k of ROM.

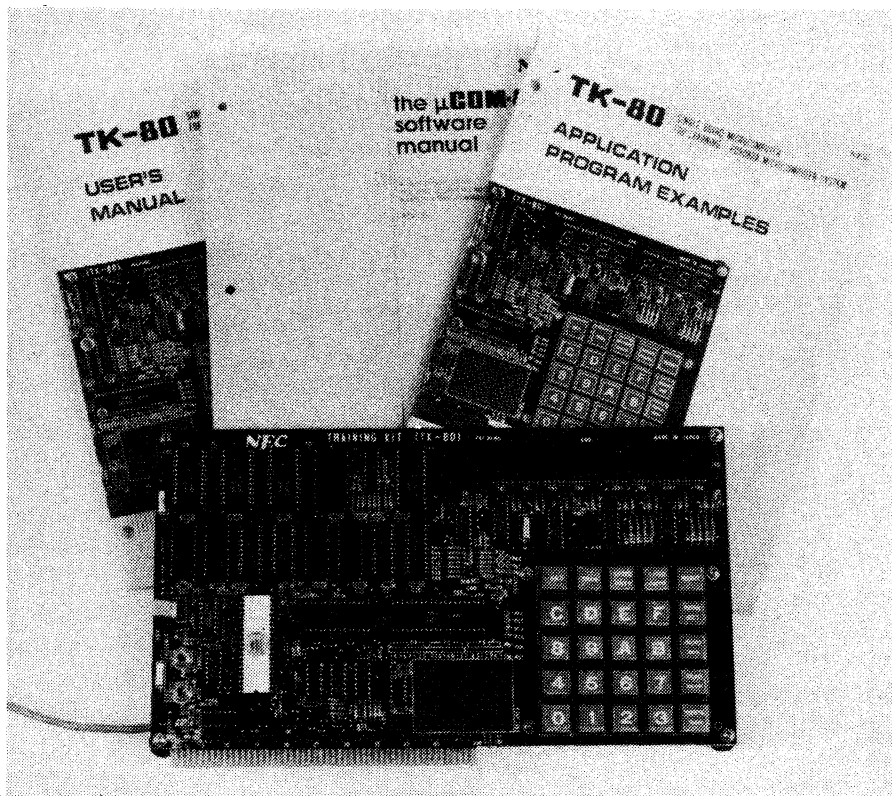
An 8225 programmable peripheral interface is used to provide two 8-bit bidirectional I/O ports, and two 4-bit bidirectional I/O ports. This unit is also used to implement the keyboard scanning, under monitor program control.

Eight 7-segment LED displays are provided, so that input data, memory address and data, and the contents of CPU registers and flags can be displayed. The required data for display is stored in RAM, and a hardwired logic circuit periodically samples this area using direct memory access (DMA) mode.

25 keys are provided for entry of monitor commands and user data. One of these is a direct reset key, with another 16 being the hexadecimal data entry keys. The remaining keys allow the following functions to be implemented:

- Read from memory with automatic address increment or decrement
- Write to memory with automatic address increment
- Program run with optional breakpoint

*This photograph of the TK-80 shows the three manuals supplied, as well as the main printed circuit board assembly.*



### Single step operation

Trace system status including all CPU registers and flags

Modify CPU registers and flags

Store and load memory to and from external audio cassette tape.

Only a single breakpoint can be set, but the number of times the breakpoint can be passed before being executed can be specified. This means it is possible to set a breakpoint in a loop, and have it acted upon after the loop has been traversed say 10 times.

Full details are provided on how to drive the LED displays, and how to get data from the keyboard. The store and load data routines operate via 110 baud teleprinter-compatible logic levels, which can be stored to and read from cassette tapes by means of a simple interface circuit. The interface as described, however, is not compatible with the Kansas City standard.

Two power supplies are required, +12V @ 150mA and +5V @ 1A. Since very low power CMOS RAMS are used, it is possible to use dry cells as a memory backup, so that programs can be retained during power failures or overnight interruptions.

The user's manual supplied with the kit contains full and complete details of the TK-80 system, including notes on power supply requirements, monitor operations, and system expansion. A circuit diagram, monitor listening and board edge finger pin assignment list are also provided.

The companion application manual contains several demonstration programs, which can be implemented with a minimum of external components. These include detailed flowcharts and program listings, and full explanations of how to use the various subroutines available in the monitor ROM.

The last four programs require the use of an audio amplifier and speaker, and implement respectively an electronic siren, a programmable metronome, an electronic organ (using the keyboard for note selection), and an automatic music player.

After working through these examples, the budding programmer should have a good understanding of programming in general and the 8080A instruction set in particular.

In conclusion, we would recommend the TK-80 single board microcomputer to those wishing to gain a thorough understanding of both the hardware and software normally used with an 8080A system. Ample provision for expansion has been provided, as well as a comprehensive explanation of the programming art and the routines resident in the monitor ROM.

Recommended retail price of the unit, which is supplied fully assembled and tested, is \$215.00 plus sales tax where applicable. Further inquiries should be directed to the Australian agents, Tecnico Electronics, P.O. Box 12, Marrickville, NSW 2204. 